

Claims

What is claimed is:

Claim 1

- 1 1. For use in a system having multiple processors coupled to a memory, a
2 method, comprising:
 - 3 a.) receiving multiple requests for data from the multiple processors;
 - 4 b.) if ones of the multiple requests are requesting the same data, creating
5 a respective linked list to record the ones of the multiple requests; and
6 c.) issuing one of the requests recorded by each linked list to the memory.

Claim 2

- 1 2. The method of Claim 1, wherein each linked list orders requests in order
2 of receipt, and wherein the issued request is the oldest pending request.

Claim 3

- 1 3. The method of Claim 1, wherein the memory issues memory requests to
2 the multiple processors for the return of data to the memory, and if a memory
3 request is requesting the same data as requests recorded within a linked list,
4 adding the memory request to the linked list.

Claim 4

- 1 4. The method of Claim 1, and further including:
 - 2 receiving requested data from the memory;
 - 3 if the received data was requested by requests recorded in a linked list,
4 providing the received data to a processor that issued a predetermined one of
5 the requests included in the linked list;
 - 6 removing the predetermined request from the linked list; and
7 processing all requests remaining in the linked list.

Claim 5

- 1 5. The method of Claim 4, wherein the predetermined request is the oldest-
2 pending request in the linked list.

Claim 6

- 1 6. The method of Claim 4, wherein the processing step includes:
2 making the next request in the linked list the current request;
3 requesting return of the received data from whichever one of the multiple
4 processors last retained the data;
5 providing the received data to whichever one of the multiple processors is
6 indicated by the current request; and
7 removing the current request from the linked list.

Claim 7

- 1 7. The method of Claim 6, wherein the memory issues memory requests to
2 the multiple processors for the return of data to the memory, wherein a memory
3 request requesting the same data as requests recorded by a linked list is added
4 to the linked list, and wherein the providing step includes providing the received
5 data to the memory if the memory is indicated by the current request.

Claim 8

- 1 8. The method of Claim 7, wherein a shared cache is coupled to the multiple
2 processors, and further including:
3 attempting to retrieve the received data from the shared cache; and
4 if, in response to the requesting step, none of the multiple processors
5 returns the received data, the providing step includes providing any data
6 retrieved from the shared cache to whichever one of the multiple processors or
7 the memory is indicated by the current request.

Claim 9

1 9. The method of Claim 8, wherein if, in response to the requesting step,
2 none of the multiple processors returns the received data, and if the received
3 data is not resident in the shared cache, indicating the current request must be
4 retried.

Claim 10

1 10. The method of Claim 9, wherein the step of receiving requested data from
2 the memory occurs before all invalidation operations are completed for the
3 received data, and further including preventing predetermined data from being
4 provided to the memory until predetermined invalidation operations are
5 completed.

Claim 11

1 11. The method of Claim 6, wherein the requesting and providing steps of
2 Claim 6 are performed during an indivisible operation.

Claim 12

1 12. A method of processing requests to a memory, including:
2 a.) receiving a request for data stored in the memory;
3 b.) if the request is requesting the same data as another request that is
4 already pending to the memory, linking the request to the other pending request;
5 and
6 c.) repeating steps a.) and b.) for any additional requests issued to the
7 memory.

Claim 13

1 13. The method of Claim 12, wherein steps a.) through .c) include creating
2 multiple linked lists of requests, each respectively associated with different data.

Claim 14

- 1 14. The method of Claim 13, and further including:
2 d.) when data for the pending request is received from the memory,
3 providing the data to a requester that issued the pending request; and
4 e.) if the pending request is linked to a request, requesting that the data
5 be returned by a requester indicated by the pending request so that the linked
6 request may be processed.

Claim 15

- 1 15. The method of Claim 14, and further including:
2 f.) providing the data to satisfy the linked request.

Claim 16

- 1 16. The method of Claim 15, and further including:
2 g.) making the linked request the current request;
3 h.) if the current request is linked to a request, requesting that the data be
4 returned by a requester that most recently retained the data;
5 i.) providing returned data to satisfy the linked request; and
6 j.) repeating steps g.) through i.) for any additional requests in the linked
7 list.

Claim 17

- 1 17. The method of Claim 16, wherein at least one of steps e.) and h.) include
2 requesting that the data is returned with predetermined access rights that are
3 based on a type of the current request and the linked request.

Claim 18

- 1 18. The method of Claim 16, wherein at least one of steps e.) and h.) include
2 requesting that the data is returned with predetermined access rights based on
3 rights that were granted by the memory for the data.

Claim 19

- 1 19. The method of Claim 16, wherein at least one of steps e.) and h.) is
2 performed in a manner that is determined programmably.

Claim 20

- 1 20. A system for processing requests to a memory, comprising:
2 multiple requesters to issue requests for data to the memory;
3 a request tracking circuit coupled to the multiple requesters to retain a
4 record of each request until the request is completed, and to associate a request
5 with any other one or more requests for the same data so that a single request
6 for any given data is pending to the memory at a given time.

Claim 21

- 1 21. The system of Claim 20, wherein the request tracking circuit includes a
2 storage device to store multiple requests for the same data in a respective linked
3 list of requests.

Claim 22

- 1 22. The system of Claim 21, wherein the request tracking circuit includes a
2 control circuit to receive data from the memory, and to provide the received data
3 to one of the multiple requesters based on information stored within the storage
4 device.

Claim 23

- 1 23. The system of Claim 22, wherein if the received data is received in
2 response to a request that has been associated with other requests, the control
3 circuit provides the received data to whichever requester issued the oldest one of
4 the associated requests, and processes each of the other associated requests in
5 the order in which the other associated requests were recorded by the request
6 tracking circuit.

Claim 24

1 24. The system of Claim 23, wherein the control circuit includes circuits to
2 process each of the other associated requests by attempting to obtain the
3 received data from one of the multiple requesters, then providing any obtained
4 data to a requester that is identifier by the request that is being processed.

Claim 25

1 25. The system of Claim 24, wherein the control circuit includes a circuit to
2 cause a requester to reissue a request if, during processing of a request, data
3 requested by the request could not be obtained.

Claim 26

1 26. The system of Claim 24, wherein the request tracking circuit includes a
2 remote tracker circuit to store a record of a request received from the memory
3 that is requesting that same data as one or more requests recorded within the
4 request tracking circuit.

Claim 27

1 27. The system of Claim 25, wherein the control circuit includes a circuit to
2 process the request from memory by attempting to obtain the requested data,
3 then providing any obtained data to the memory.

Claim 28

1 28. The system of Claim 23, wherein the memory provides data to the request
2 tracking circuit before all invalidation operations for the data have been
3 completed, and wherein the request tracking circuit includes a circuit to prevent
4 predetermined data retained by predetermined ones of the multiple requesters
5 from being returned to the memory before all of the invalidation operations are
6 completed.

Claim 29

- 1 29. A data processing system comprising:
2 a memory;
3 a processing node coupled to the memory to issue requests for data to the
4 memory, wherein the processing node includes a requesting tracking circuit to
5 record, in time-order, requests issued for the same data, and to allow only one of
6 the requests for the same data from being issued to the memory at a given time.

Claim 30

- 1 30. The system of Claim 29, wherein the processing node includes multiple
2 processors, and wherein the requesting tracking circuit includes a control circuit
3 to receive data returned from the memory, the control circuit to provide the data
4 to the processor associated with the oldest request pending for the data.

Claim 31

- 1 31. The system of Claim 30, wherein the control circuit includes a circuit to
2 determine whether other requests are pending for the received data, and for
3 each of the other pending requests, attempting to obtain the data from whichever
4 of the multiple processors last retained the data, then providing any obtained
5 data to a processor that is associated with the request being processed.

Claim 32

- 1 32. The system of Claim 31, wherein the control circuit processes the multiple
2 requests for the received data in an order in which the multiple requests were
3 received.

Claim 33

- 1 33. The system of Claim 32, wherein the request tracking circuit includes a
2 control store to store programmable data to indicate the manner in which the
3 data is to be obtained from a processor based on access rights retained by the

4 processor for the data and the access rights requested by the processor
5 associated with the request being processed.

Claim 34

1 34. A system for processing requests to a memory, including:
2 processing means for issuing the requests to the memory; and
3 request tracking means for receiving the requests, and for forming an
4 association between any of the requests that are requesting the same data, and
5 for allowing only one of the associated requests to be issued to the memory.

Claim 35

1 35. The system of Claim 34, wherein the association records an order of
2 receipt of the requests that are requesting the same data.

Claim 36

1 36. The system of Claim 35, wherein the request tracking means includes
2 control means for receiving data from the memory, and if the received data was
3 requested by associated requests that are requesting the same data, for
4 processing each of the associated requests in the order in which the requests
5 were received.

Claim 37

1 37. The system of Claim 36, wherein the control means includes means for
2 processing each request by obtaining the data with access rights required to
3 process the request, then providing the data to the processing means with the
4 required access rights.